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Palaemon vesolensis n. sp. (Crustacea, Decapoda) from the Plattenkalk of Vesole Mount (Salerno, Southern Italy)

Abstract - The decapod crustacean assemblage preserved into an outcrop of thin laminated limestones (Plattenkalk) Upper Cretaceous (Campanian-Maastrichtian) in age, is studied. This horizon crops out in the highest part of the Mesozoic stratigraphic succession of Vesole Mount (tab. IGM 1:25.000: 198 - III SE, Trentinara), few tens of metres below the transgressive boundary of the Upper Paleocene-Eocene Trentinara Formation.

One hundred, both complete and incomplete specimens were studied, and this sample led to describe *Palaemon vesolensis* n. sp. (infraorder Caridea Dana, 1852, family Palaemonidae Rafinesque, 1815). This finding increases the stratigraphic range of *Palaemon* Weber, 1795, only known to date from the Oligocene fossil record.

The new biostratigraphic, sedimentologic and palaeoecologic observations carried out on this decapod crustacean outcrop have confirmed not only the ascription to the Upper Cretaceous, but have also allowed to suppose its scarce circulation of waters and low oxygenation conditions, high ecological stress, sedimentation linked to tide contributions, subject to storm events and populated by oligotypic faunae.

Key words: Crustacea, Decapoda, Upper Cretaceous, Plattenkalk, Southern Italy

Riassunto - *Palaemon vesolensis* n. sp. (Crustacea, Decapoda) del Plattenkalk del Monte Vesole (Salerno, S. Italia).

Viene studiata la fauna a crostacei decapodi presente in un pacco di strati calcarei sottilmente laminati (Plattenkalk) del Cretacico superiore (Campaniano-Maastrichtiano), affioranti nella parte più alta della successione stratigrafica mesozoica del Monte Vesole (tav. IGM 1:25.000: 198 - III SE, Trentinara), poche decine di metri al di sotto del limite trasgressivo con i terreni del Paleocene superiore-Eocene della Formazione di Trentinara.

Gli esemplari esaminati ammontano complessivamente a un centinaio, tra completi e frammentari, e sono stati attribuiti a *Palaemon vesolensis* n. sp. (infraordine Caridea Dana, 1852, famiglia Palaemonidae Rafinesque, 1815). Questa descrizione amplia la distribuzione stratigrafica di *Palaemon* Weber, 1795, sino a ora segnalato nel record fossile solo nell'Oligocene.

Le nuove osservazioni biostratigrafiche, sedimentologiche e paleoecologiche condotte sul giacimento a crostacei decapodi, oltre a confermarne l'attribuzione al Cretacico superiore, ne lasciano ipotizzare la deposizione in una laguna probabilmente prospiciente ad ambienti dulcacquicoli e terre emerse, con condizioni di scarsa circolazione delle acque e scarsa ossigenazione, elevato stress ecologico, sedimentazione legata ad apporti mareali, soggetta a episodi di tempesta e popolata da faune oligotipiche.

Parole chiave: Crustacea, Decapoda, Cretacico superiore, Plattenkalk, S. Italia.

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Introduction

Scorziello & Sgrosso (1965) reported about a decapod crustacean level at Vesole Mount (Salerno), ascribing it to the Paleocene.

Sgrosso (1968) ascribed this level to the upper part of the Senonian, or probably Maastrichtian, but without excluding the Lower Paleocene, after a new biostratigraphic study on Vesole Mount's sequence.

This paper deepens the systematic study of the decapod crustaceans of this level (here named Vesole Mount Plattenkalk). The importance of this study is due to the absence of data about these organisms referring to the Southern Apennines and to the studied period (Upper Cretaceous - Paleocene). The Plattenkalk's age is also re-examined and a reconstruction of the depositional environment by a biostratigraphic and sedimentologic study in thin sections and by new field observations is suggested.

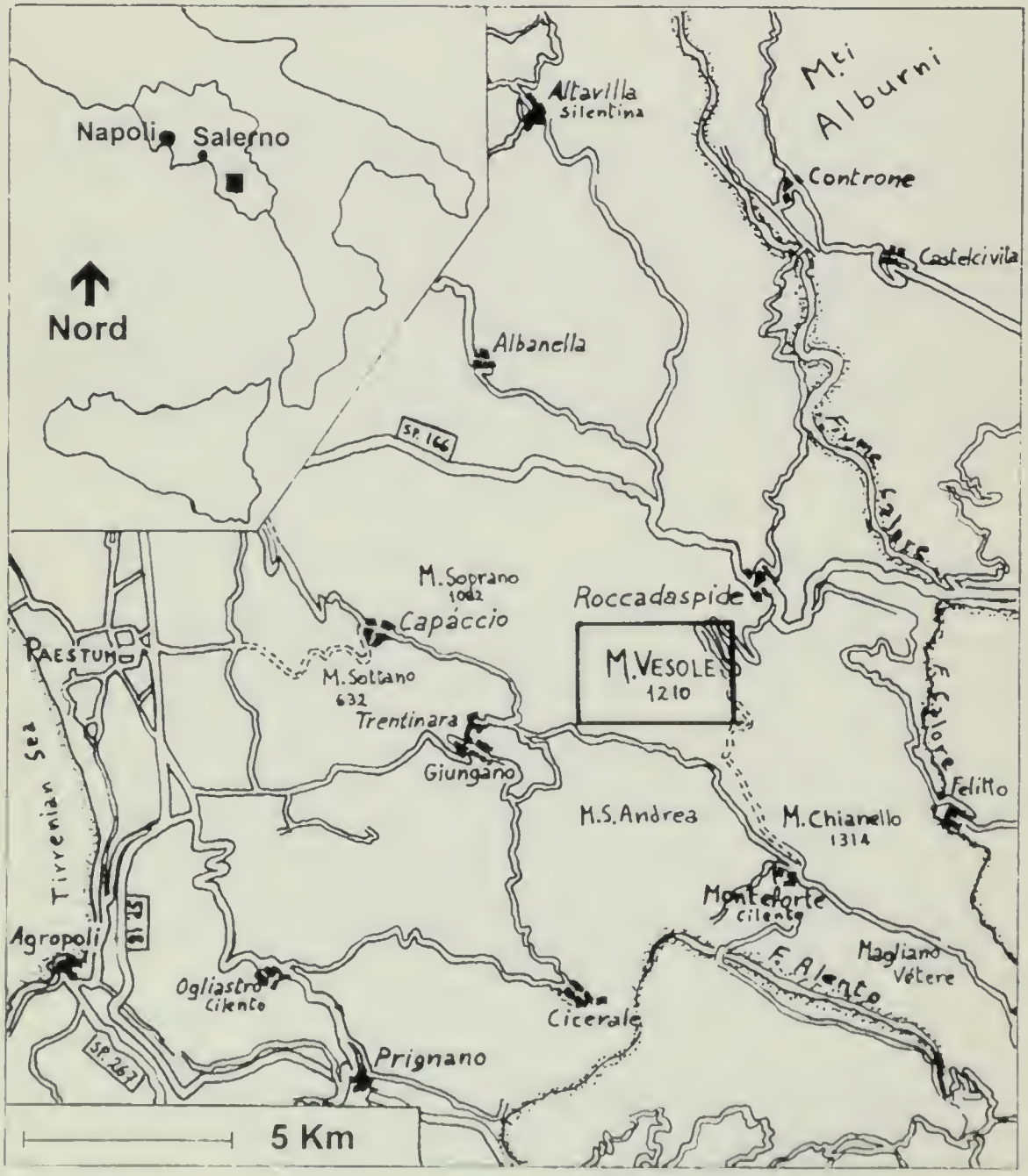

Fig. 1 - The geographical position of Vesole Mount, in the Province of Salerno (Southern Italy).

Geological setting

The essentially carbonatic geological structure to which Vesole Mount belongs (tab. IGM 1:25.000: 198 – III SE, Trentinara; Fig. 1), forms a ridge extending about 20 km WNW – ESE, included between the small towns of Capaccio Vecchio and Magliano Nuovo (Salerno, S Italy). Moreover, two parallel and smaller ridges are present W of Vesole Mount: the higher and wider culminating in Soprano Mount (1083 m), and the lower one culminating in Sottano Mount (832 m). The main ridge represents a steep relief whose highest peak is Chianiello Mount (1314 m). This Mount divides the basins of the rivers Calore to the North and Alento to the South, both getting set on terrigenous formations and characterized by gentle landscapes. This ridge represents a deformed portion of a Meso-Cenozoic carbonatic platform domain («Campania-Lucania platform» by D'Argenio *et al.*, 1973; «Apennine platform» by Mostardini & Merlini, 1986). The stratigraphic sequence of this carbonatic platform is about 4 km thick and it is constituted by: 1) Upper Triassic dolomite; 2) Jurassic-Cretaceous limestones and dolomitic limestones; 3) Upper Paleocene-Middle Eocene mudstones, rudstones and marls (Trentinara Formation – Selli, 1962); 4) Aquitanian-Burdigalian (Lower Miocene) bioclastic and glauconitic grainstones (Capaccio and Roccadaspide Formations – Selli, 1957, 1962; Sartoni & Crescenti, 1963); 5) Middle Miocene clays, marls, quartzose and lithic sandstones (Bifurto Formation – Selli, 1957). However, the rising portion of the ridge essentially consists of Cretaceous and Paleocenic-Miocenic formations. The Meso-Cenozoic carbonatic platform is covered, in the region, by the oceanic materials belonging to the Auct. «Ligurid Units», consisting of limestones, marls, clays and sandstones (North-Calabrian and Sicilid Units by Bonardi *et al.*, 1988). Above the Auct. «Ligurid Units», in stratigraphic unconformity, the sandstones, marls and limestones of the Cilento group, Upper Burdigalian and Langhian in age, are present (Amore *et al.*, 1988).

The general structure of the limestone ridge has been traced back as a simple monocline or, as much as a gentle anticline, subsequently cutted by faults (Scandone, 1967; Sgrosso, 1968; Cestari, 1971). In fact its morphology is asymmetric, with a steep southern side controlled by high-angle border faults, and a more gentle northern side.

Recently, a greater structural complexity of the ridge has been recognized. Berardi *et al.* (1996) suggested that the Soprano Mount relief could correspond to a hinge-faulted ramp anticline. The recent geological survey in a 1:10.000 scale and the structural analysis carried out by one of us (S. Bravi), between Trentinara and Magliano Nuovo villages, attest a sequence of thrusts with local phenomena of backthrusting, followed by a dislocation of the folds and thrusts due to WNW-ESE and NW-SE trending high-angle poliphasic faults. Similar overthrust sequences have also been reconstructed in the adjacent area of Cervati Mount (Castellano & Schiattarella, 1998).

Previnos observations on the stratigraphy of Vesole Mount

Sgrosso (1968) described the stratigraphic succession of Vesole Mount dividing it into ten stratigraphic intervals (*a* to *l*) the first six (*a-f*) of which are surely ascribed to the Upper Cretaceous. They represent a cronostrati-

graphic sequence about 710 m thick, ranging in age from the Cenomanian to the Senonian. A 40 m thick interval (*g*) including the decapod crustacean layers, follows the first six. The described microfauna for this interval is chiefly represented by *Spirolina* sp., *Rotalia* sp., rotaliform foraminifers, Nubeculatids, Trochamminids, Ophtalmidids and Miliolids. Charophytes gyrogonites are also present. Sgrosso (1968) ascribed this faunistic assemblage to the Senonian and, probably, to the Maastrichtian, even though forms with paleocenic affinities are present (e.g. *Spirolina* sp.). This ascription was also confirmed by an additional sampling of heteropic strata (interval *m*), carried out in a close area, highlighting a constant presence of Rudists, together with microfossils certainly ascribed to the Upper Senonian, among which *Rhaphydionina liburnica* (Stache), *Accordiella conica* Farinacci, *Moncharmontia apenninica* (De Castro), *Rotorbinella scarsellai* Torre and *Sgrossoella parthenopeia* De Castro.

The presence of forms showing a Paleocenic affinity is therefore explained by an ecological variation due to the particular sedimentary environment of the decapod crustacean limestsones.

Intervals *h* (about 70 m thick and also ascribed to a probable Maastrichtian) and *i* follow interval *g*. Interval *i*, starting with a transgressive horizon, perfectly represent the Paleocenic Trentinara Formation (Selli, 1962; Barattolo & Parente, 1991), both for the lithologies and for microfossiliferous contents. A thick, lenticular horizon of red clays with bauxitic nodules follows interval *i*, preluding a new trasgression represented by a 10 m thick sequence of glauconitic grainstones containing Miocenic microfaunae, which can be ascribed to Roccadaspide Formation (Selli, 1957).

Interval *g* including the decapod crustacean layers, is widely described in the following section, from a sedimentologic and cronostratigraphic point of view.

Fig. 2 - The southern slope of Vesole Mount. In the upper part is present the Plattenkalk.

«Interval g», with decapod crustaceans

This horizon, about 45 m thick, is present at 1100 m above sea-level, in the portion of stratigraphic sequence cropping out at the southern side of Vesole Mount (1210 m), few tens of metres beneath the top (Fig. 2). The prevailing thin stratified limestones and marly limestones make it easy erodible and therefore covered by a grassland, compared to the underlying and over-lying thick, calcareous well rising strata. The average strata dip is 25° NE. The decapod crustacean interval is laterally limited by a fault on the right, which is marked by a narrow band of cataclastic breccia, putting it in touch with the light-brown mudstones that are probably ascribed to interval *f* (Sgrosso, 1968). On the left it seems to turn into light-brown mudstone thicker strata.

Thick and hard light-brown wackestone and packstone strata are present just under interval *g*.

The studied interval can be divided into seven parts, from bottom to top (Fig. 3):

g1) about 2 m of light-brown marly and bituminous mudstones, with centimetric strata and sometimes millimetric laminae;

g2) about 1.5 m of dark-grey, finely laminated mudstones, bituminous and fetid if hammered, sometimes including small clasts; not laminated, thin mudstone strata are sometimes intercalated among the laminated ones. The first occurence of decapod crustaceans and turriculated gastropods have been observed inside this laminated facies;

g3) about 2 m of hard wackestone and packstone strata;

g4) about 2.5 m of bituminous, closely stratified mudstones, with millimetric laminae and centimetric strata. The lamination is sometimes convolute. Remains of decapod crustaceans in bad state of preservation are present;

g5) about 22 m of dark-grey or black bituminous and closely laminated mudstones, fetid if hammered, very rich in crustacean decapod remains, sometimes in a good state of preservation. The laminae sometimes show a weak undulated course to the metric and decimetric scale. The better preserved decapod crustaceans are usually present where the laminae have a flat-parallel course. The fossil remains are distorted, incomplete or absent where the lamination has an undulated course;

g6) about 8 m of light-brown packstones and wackestones in 50-100 cm thick, non-laminated strata, alternated with sets of calcareous-marly bituminous millimetric laminae. These laminae still preserve rare fragments of decapod crustaceans and turriculated gastropods. The frequence of the laminated horizons decreases upwards;

g7) about 7.5 m of white mudstones in 80-100 cm thick strata, with dessiccation cavities filled by geopetal silt.

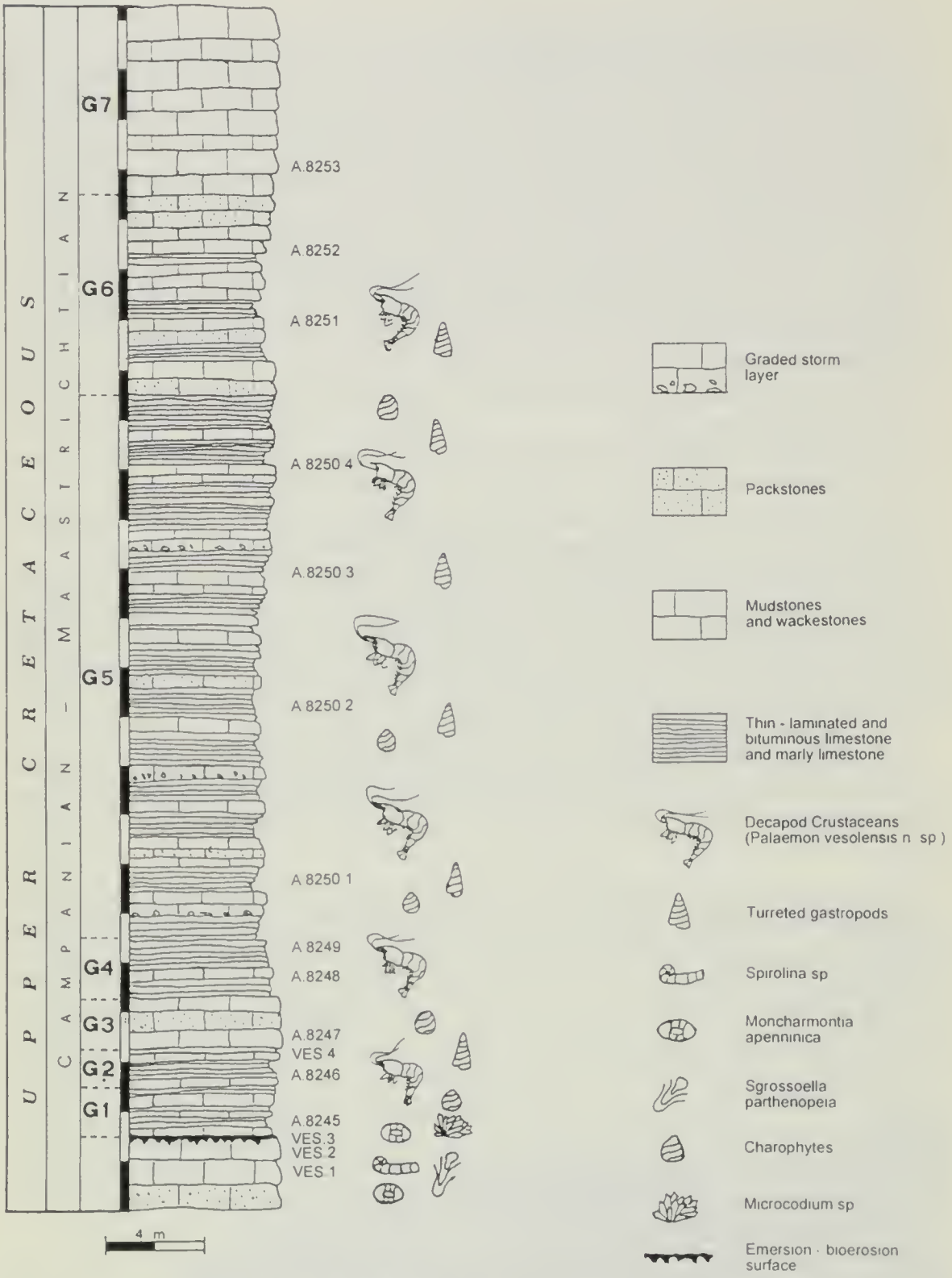

Fig. 3 - Stratigraphic log of the interval «g» with decapod crustaceans at Vesole Mount (Southern Italy).

Biostratigraphy and age

A stratigraphic sampling was carried out in «interval g» and in the underlying strata. The lowest samples (e.g. VES.1, Fig. 4a), picked up in the wackestones and packstones underlying the first laminated horizons, have

highlighted a foraminifer microfauna assemblage with *Moncharmontia apenninica* (De Castro), *Cuneolina* sp., *Accordiella conica* Farinacci, *Dicyclina* sp., *Quinqueloculina* sp., *Pyrgo* sp., *Nummoloculina* sp., *Rotorbinella scarsellai* Torre, *Sgrossoella parthenopeia* De Castro, Nubeculariids, Miliolids, Textulariids, Soritids, Rotaliids, together with *Thaumatoporella* sp., *Clypeina*-like Dasycladaceans (Fig. 4b), fragments of Radiolitids, ostracods and charophyta gyrogonites. Nevertheless a horizon in this basal portion of the sequence (sample: VES.2, Fig. 5a) has highlighted a microfauna assemblage with forms ascribed to *Spirolina* sp., together with Textularids, *Chrysalidina*-like forms, rare Miliolids and ostracods.

A reddish decimetric layer, with bioerosion and a very rich development of *Microcodium* colonies (sample: VES.3, Fig. 6), is located right under the first laminated strata of decapod crustacean facies. Remaining zones of the original, very rich microfossils wackestone-packstone (Fig. 5b) are present among *Microcodium* colonies and contain *Moncharmontia apenninica* (present with well developed individuals), *Moncharmonthia compressa* (De Castro), *Sgrossoella parthenopeia*, *Rotorbinella scarseelai*, Miliolids, Textulariids, *Aeolisaccus* sp. and *Thaumatoporella* sp.

The finely laminated and bituminous facies, with crustacean decapods and sometimes rich in turreted gastropods, rare plant remains and elongate leaves, grows upwards in the subintervals from *g1* to *g5* (samples: from A.8245 to A.8250; VES.4). This part of the sequence, also in the more detrital layers, includes rare microfaunas, poorly indicative by a cronostratigraphic point of view, essentially consisting in ostracods (Fig. 12b), small-sized and often re-crystalized hyaline and arenaceous foraminifers, small-sized Texturaliids and Miliolids, charophyta gyrogonites. Stromatolitic laminations are sometimes present.

Subintervals *g6* and *g7* are characterized by a progressive reduction of the finely laminated horizons and by the prevalence of 1 m thick mudstone and packstone layers. They also contain a poorly indicative microfauna, very similar to that of the previous horizons.

The described microfauna allows to ascribe with certainty the basal part of the examined sequence to the Upper Cretaceous and in particular to the Upper Senonian, for the presence of *Moncharmontia apenninica*, *Sgrossoella parthenopeia*, *Cuneolina* sp., *Accordiella conica* and *Rotorbinella scarsellai* (De Castro, 1991; Chiocchini *et al.*, 1994). The contemporaneous presence of forms with a Paleocenic affinity (*Spirolina* sp.) in some horizons of the basal part of the examined sequence and the following return of clearly Cretaceous forms (*Moncharmontia apenninica* with big-sized specimens, *Moncharmontia compressa* and *Sgrossoella parthenopeia*, in the sample VES.3) indicate that the presence of *Spirolina* sp. doesn't necessarily imply a Paleocenic age for these layers. Its presence, as already pointed out by Sgrosso (1968) and suggested by De Castro (pers. rem.), may be related to the particular depositional environment of the Plattenkalk. Therefore the Plattenkalk may be dated back to the Upper Cretaceous and very probably to the Campanian-Maastrichtian. This ascription is based on the above-mentioned observations and on the observations by Sgrosso (1968), who reconstructed its heteropy with Senonian layers. Moreover the geological survey carried out by one of us (Sergio Bravi) in the entire area of the border-

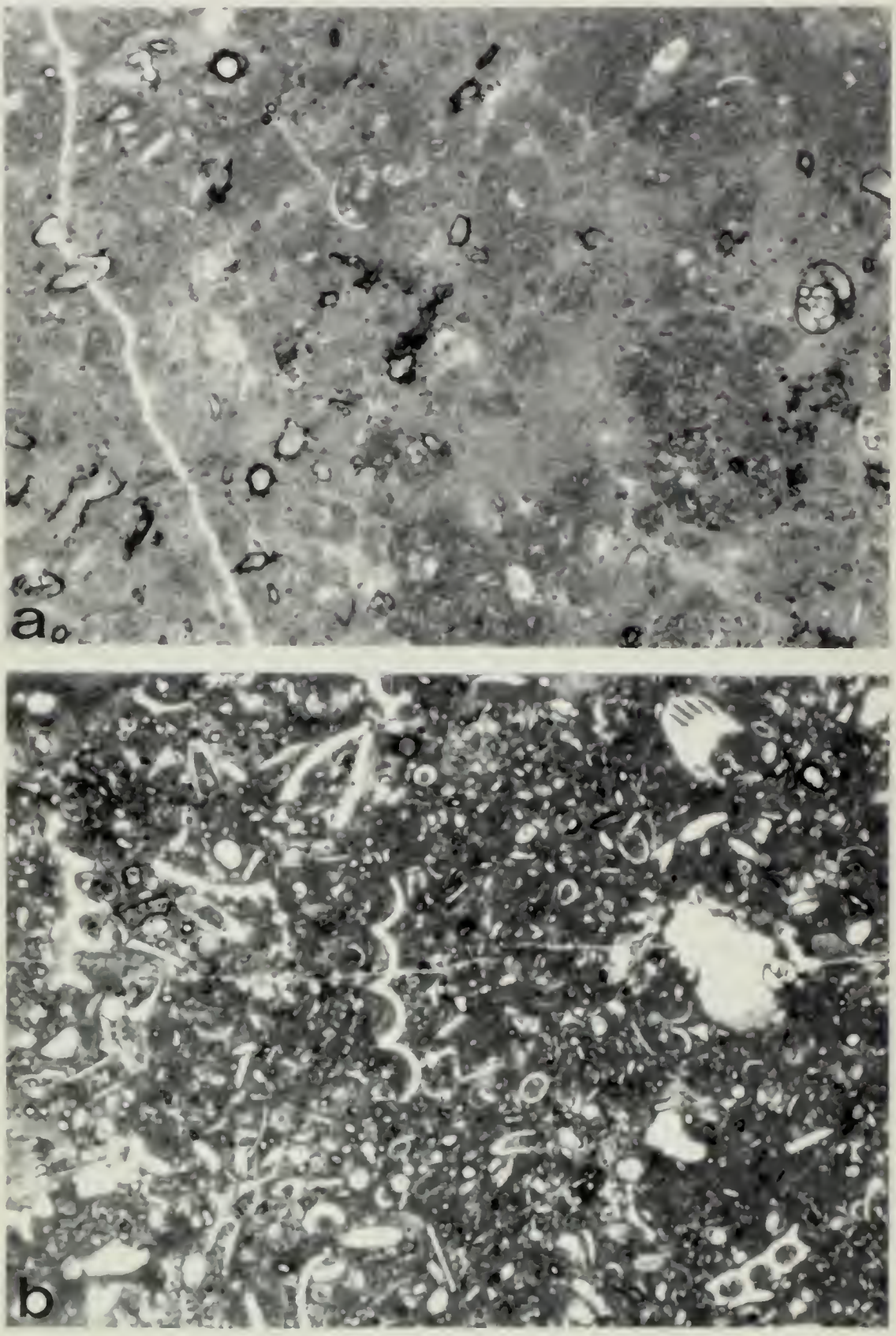

Fig. 4 - a) Wackestone-Packstone with *Moncharmontia apenninica* (De Castro), *Sgrossoella parthenopeia* De Castro, small Miliolids, ostracods, Textulariids, *Aeolisaccus* sp., small *Thaumatoporella* sp. and *Clypeina*-like Dasycladaceans (b). Thin sections: VES.1 (4a) about 30x; VES.1a (4b) about 16x. For both the figures - Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, strata immediately below the Plattenkalk with decapod crustaceans.

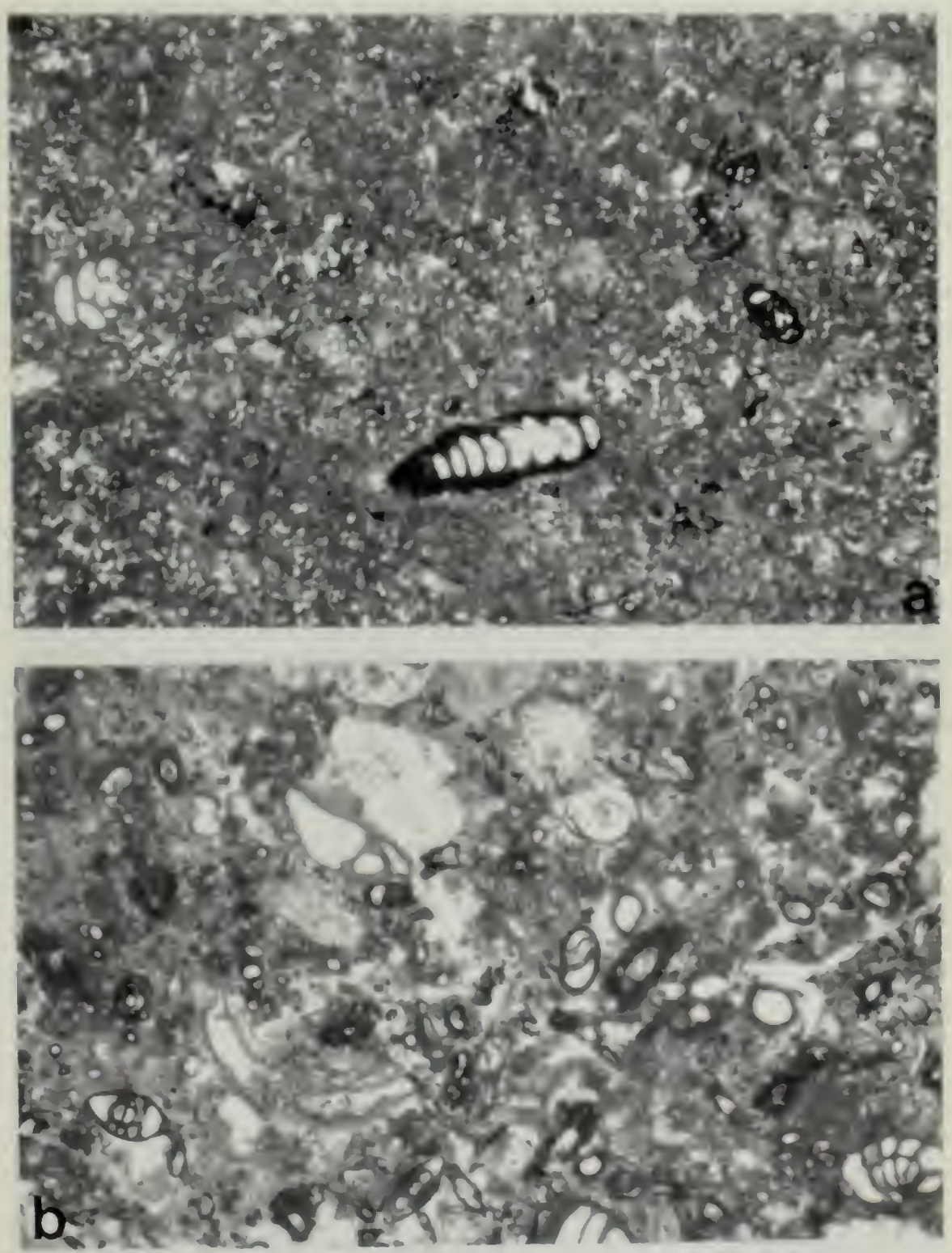

Fig. 5 - a) Packstone with *Spirolina* sp., *Chrysalidina*? sp., small Miliolids, Textulariids and ostracods. Thin sections: VES.2 about 15x. b) Packstone with *Moncharmontia apenninica* (De Castro), *Moncharmontia compressa* (De Castro), *Sgrossoella parthenopeia* De Castro, *Aeolisaccus* sp., *Thaumatoporella* sp., Miliolids and Textulariids. Thin sections: VES.3 about 25x. For both the figures - Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, strata immediately below the Plattenkalk with decapod crustaceans.

Fig. 6 - Microfacies with *Microcodium* sp. and *Thaumatoporella* sp.. The colonies of *Microcodium* have bioeroded the original microfossiliferous limestone, leaving unchanged just small areas between the algal colonies. The unchanged areas contain the microfauna described in Fig. 5b. This *Microcodium* horizon constitutes the stratum that lies just below the first laminated layers with decapod crustaceans. Thin sections: VES.3 about 25x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, strata immediately below the Plattenkalk with decapod crustaceans.

ing calcareous ridge of Chianello Mount, highlighted that a 1 m thick layer containing the first Paleocenic Alveolinae (Upper Paleocene) marks the passage from the Upper Cretaceous to the Paleocene in the entire area. This Alveolinae horizon at Vesole Mount, as pointed out by Sgrosso (1968), is present in interval «*i*» of the stratigraphic sequence, at least 70 m above the decapod crustacean Plattenkalk.

Sedimentological and palaeoenvironmental remarks

Wackestone-packstone horizons with a «normal» inner platform, lagoonal microfauna are present at the base of Plattenkalk. A *Microcodium* bioerosion horizon (Figs. 3, 6) lies just below the first Plattenkalk layers and may prove an emersion phase of the area, before the transition to a strongly restricted environment.

The close lamination that marks the Plattenkalk of Vesole Mount, the widespread presence of bitumen and the marly component of the laminae represent evidences of a low carbonatic sedimentation rate, with low oxygenated and semi-stagnant waters close to the bottom, such as an inner platform stagnant lagoon. However, some Plattenkalk intervals show a undulated lamination, probably due to transitory currents, stromatolitic horizons and, sometimes, graded intraclastic layers showing, at their base, both muddy clasts and dried stromatolitic «*chips*» removed from the bottom and resedimented, probably by storms (Fig. 7).

Moreover, the sampling in a continuous sequence of a restricted portion (about 30 cm thick), but well representative of the general facies of subinterval g5 of the Plattenkalk, highlighted, by the study of thin sections, that the millimetric laminae have often a graded structure (Fig. 8), probably due to tide-sedimentation processes that regularly supplied new fine material depositing by decantation (Archer *et al.*, 1990; Archer & Feldman, 1994). Bioturbation (Fig. 9a) is sometimes present, causing disgregation of the laminae. Most of the mud forming the laminae and thin layers consists of crustacean fecal pellets (Fig. 9b), surely made by the same population of the basin. The disarticulated calcitic fragments of *Microcodium* alga sometimes form small lenticular heaps inside muddy sediment.

Decapod crustaceans are sometimes very abundant on the surface of the laminae (Fig. 10) and they are often in good state of preservation. They are sometimes disarticulated and often associated with many turreted gastropods forming a monospecific population (Figs. 11a, 12a). Gastropods are also present in the thicker layers, where crustaceans are generally absent.

The above reported fossilization conditions allow to confirm a protected lagoonal environment, with a low sedimentation rate. A large quantity of crustacean decapods exuviae accumulated on the bottom during the starvation periods, but real mass-mortalities occurred only periodically: these last are witnessed by some horizons containing very well preserved crustaceans that often show a darker colour, still preserving the soft-tissues derived, dark organic matter in the carapace. Turriculated gastropods instead, closely recall the present coastal lagoons and tide puddles – often populated by *Cerithium* – with high temperatures and often hypersaline environment, with oligotypic faunae. The presence of charophyta gyrogonites in some layers may prove freshwater periodic contributions.

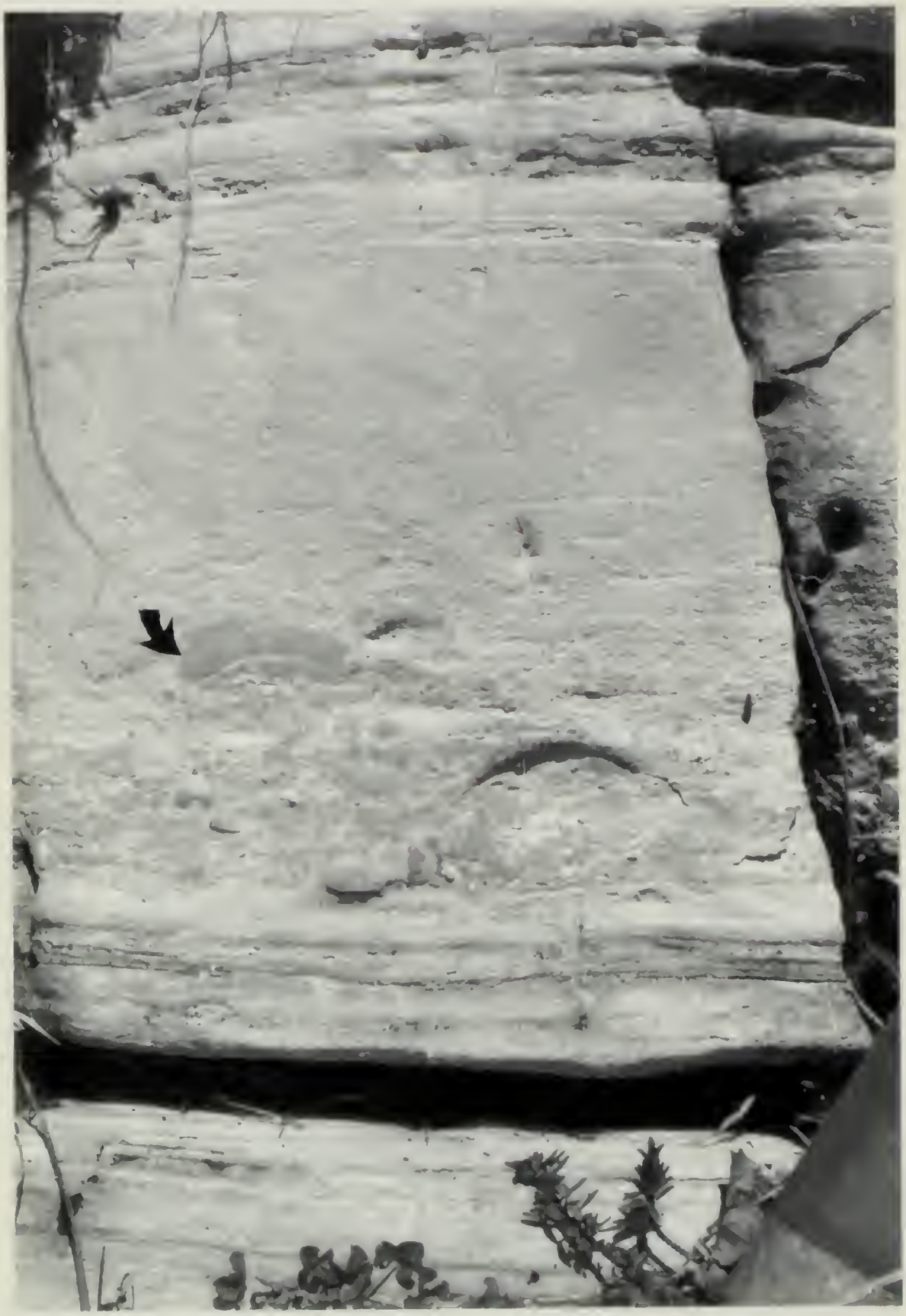

Fig. 7 - Detail of the Plattenkalk with decapod crustaceans of Vesole Mount. A storm-layer is visible intercalated between regularly laminated horizons. The storm-layer shows a clear grading of the clasts from the base toward the top. Among clasts in the basal part, stromatolitic chips (indicated by the arrow) displaced from the bottom and resedimented, are present. Magnification: 1x. Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval *g*5).

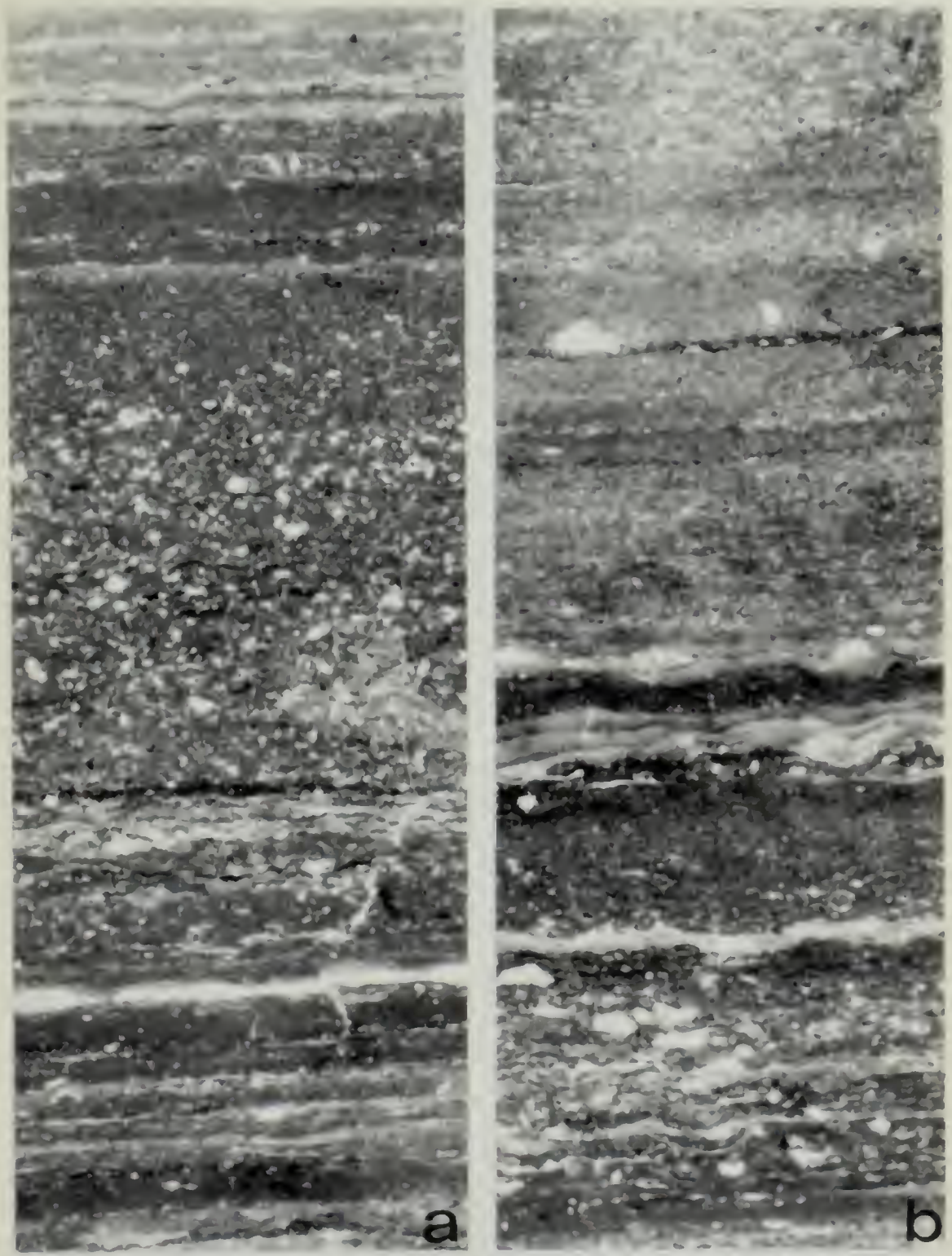

Fig. 8 - Details of the thin-laminated strata of the Plattenkalk of Vesole Mount. Notice the finely graded structure of some sedimentary micro-horizons (e.g.: the central part of the photo *a*), probably due to the decantation of fine sediment washed in the basin by tides. In photo *a* (lower and upper parts) and in photo *b* (central part) are also visible thin, darker and more or less regular laminae and irregular, thin, greyish laminae. The first are probably due to decantation and heap of fine organic sediment on the bottom; the second are probably due to the development of algal films on the bottom. The fine-grained material in the laminae and in the microturbidite layers is mainly constituted by ostracod tests and small, recrystallized foraminifers. Thin sections - Fig. 8a: VES.1Pa about 12x; Fig. 8b: VES.7P about 16x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g.5).

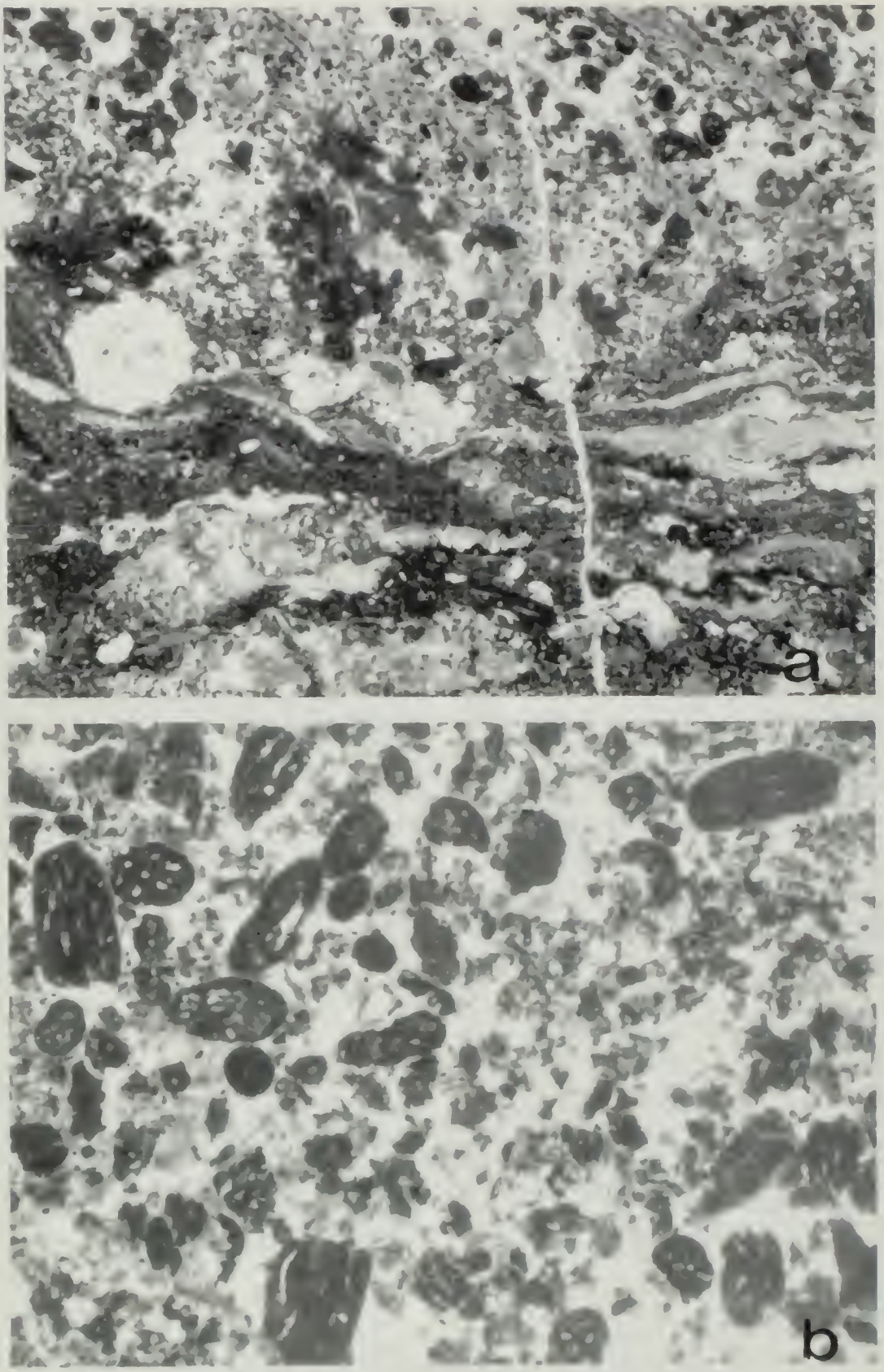

Fig. 9 - a) Broken lamination (lower part of the photo) probably by bioturbation. In the upper part of the photo, abundant crustacean fecal pellets are visible; the white area on the left is a sparry charophyte gyrogonite. b) Detail of the thin section of the photo *a*; the crustacean fecal pellets are visible in detail (cfr. *Favreina* sp.). Thin section: VES.2P, about 19x (Fig. 9a), about 38x (Fig. 9b). Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5).

Fig. 10 - Both complete and disarticulated decapod crustaceans on the surface of the laminae of Vesole Mount Plattenkalk. A wide part of the specimens is costituted by exuviae, but some laminae seems to represent real mass-mortality events, because a wide part of the specimens shows a darker colour than that of the exuviae, due to the soft-tissues that were still preserved. Magnification: about 1.5x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5)

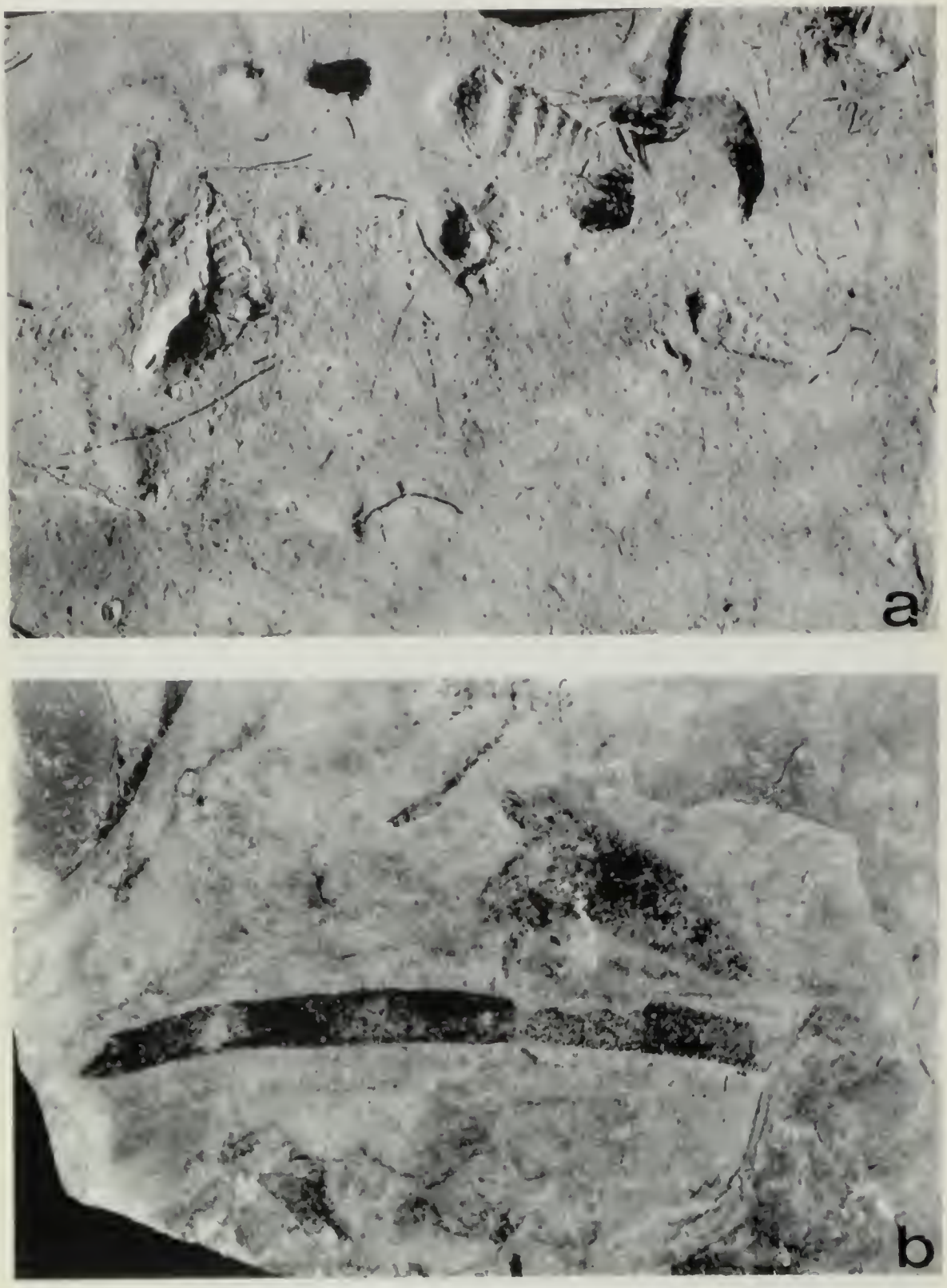

Fig. 11 - a) The typical fossil association of Vesole Mount Plattenkalk. It is constituted by decapod crustaceans and turriculated gastropods. The high number of monospecific specimens belonging to the two taxa is characteristic of high ecological stress environment, populated by oligotypic faunae.
b) Some layers of the Plattenkalk contain plant remains, at least in part belonging to land plants.
Magnification: 1.5x. Age: Upper Cretaceous (Campanian-Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g.5).

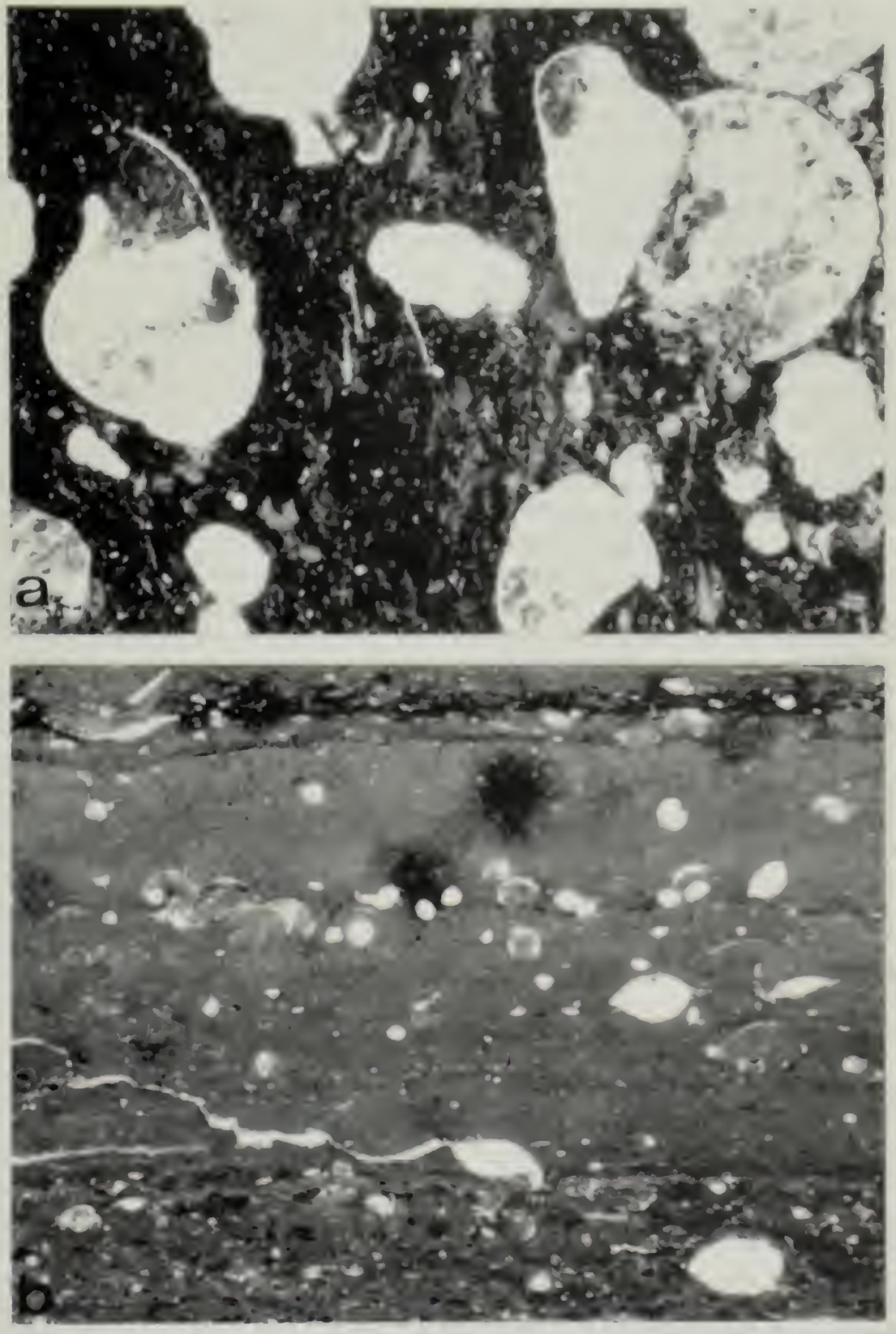

Fig. 12 - a) Thin section from a stratum with turriculated gastropods from Vesole Mount Plattenkalk. The gastropods are completely recrystallized and often filled by sparry calcite. Thin section: VES.g about 12x. b) A detail of the thin-laminated strata of Vesole Mount Plattenkalk. The laminae often contain abundant ostracods with thin valves. A number of ostracods in the photo show still articulated valves, filled by sparry calcite. Thin section: VES 5P about 10x. For both the figures - Age: Upper Cretaceous (Campanian- Maastrichtian). Horizon and locality: Vesole Mount, Plattenkalk with decapod crustaceans (subinterval g5).

In conclusion, the sedimentation environment of Vesole Mount Plattenkalk seems to represent a coastal lagoonal biotope with a scarce water-circulation and low oxygenation, rhythmic sedimentation mostly linked to tides, subject to storms, with a high ecological stress and populated by oligotypic faunae (we must point out the total absence of organisms such as fishes and echinoderms). Moreover, the presence of charophyta gyrogonites and carbonious plant remains should prove the presence of freshwater environments and lands nearby the lagoon.

Modes of preservation and materials

The macruran decapod crustaceans of Vesole Mount are preserved in light-brown thin layers of marly lithographic limestone, flattened on the layer surface. The soft consistency of the surrounding rock makes their preparation easy.

The examined sample consists of 93 specimens so divided: 27 belong to De Castro's collection and 66 to the palaeontological collection of the Museo di Storia Naturale di Milano.

All the specimens have been ascribed to *Palaemon vesolensis* n. sp. (infraorder Caridea Dana, 1852, family Palaemonidae Rafinesque, 1815). A so abundant sample induced us, in a first time, to divide the specimens in different dimensional classes, but after a deeper analysis we have considered it as different onthogenetic stages of the same species.

The study of decapod crustaceans of the Upper Cretaceous of Vesole Mount (Salerno, S Italy) is part of a research programme on lithographic limestones of Campania that the Palaeontology Department of the Università di Napoli has been carrying out for many years; moreover, this study is part of a research programme on Mesozoic macruran decapod crustaceans that the Invertebrate Palaeontology Department of the Museo di Storia Naturale di Milano has been carrying out for many years on materials from its own and other Museums' collections. Up to now this programme brought to the description of important Italian and foreign Mesozoic faunistic assemblages, such as the Triassic association of the Ambilobè region (NW Madagascar) (Garassino & Teruzzi, 1995a), of Cene (Seriana Valley, Bergamo – N Italy) (Pinna, 1974), of Prati di Rest (Valvestino, Brescia – N Italy) (Pinna, 1976), of Ponte Giurino (Imagna Valley, Bergamo – N Italy) (Garassino & Teruzzi, 1993), of Carnia (Udine, NE Italy) (Garassino *et al.*, 1996b, Garassino, in press) and of the Muschelkalk (Anisian-Ladinian) of Germany (Garassino *et al.*, work in progress); the Lower Jurassic fauna of Osteno (Lugano Lake, Como – N Italy) (Pinna, 1968, 1969; Garassino & Teruzzi, 1990; Teruzzi, 1990; Garassino, 1996) and the Cretaceous assemblages of Trebiciano (Trieste, NE Italy) (Garassino & Ferrari, 1992), of Lebanese outcrops (Garassino, 1994), of Vernasso (Udine, NE Italy) (Garassino & Teruzzi, 1995b, Garassino, in press), of Las Hoyas (Cuenca, Spain) (Garassino, 1997a), of Pietraroia (Benevento, S Italy) and Petina (Salerno, S Italy) (Bravi & Garassino, 1998 a,b) and of Torrente Cornappo Valley (Udine, NE Italy) (Garassino, 1997b, 1998).

Acronyms: A: Collezione Prof. P. De Castro; MSNM: Museo di Storia Naturale di Milano.

Abbrevations

pt - protopodite	en - endopodite	ex - exopodite	t - telson
di - diaeresis	c - carina	s - spine	

Systematic Palaeontology

Infraorder Caridea Dana, 1852
Family Palaemonidae, Rafinesque, 1815
Genus *Palaemon* Weber, 1795

Palaemon vesolensis n. sp.
Figs. 13, 14, 15, 16, 17

Diagnosis: subrectangular carapace; long rostrum with 7 suprarostral teeth forwards protuded and 3 subrostral teeth; somite II with subround pleura partly overlapping that of somite I and III; three-flagellate antennulae; pereiopods I-II chelate with elongate merus and carpus; telson with two pairs of spines on dorsal surface and one pair of spine to the distal extremity; exopodite with diaeresis.

Derivatio nominis: referring to Vesole Mount where the specimens were discovered.

Holotype: A4491/8.

Paratypes: A4491/1; A4491/19; MSNM i24780, i24785.

Type locality: Vesole Mount (Salerno, S Italy).

Geological age: Upper Cretaceous.

Materials. 93 complete and fragmentary specimens, in lateral and dorsal view and in good state of preservation.

A4491/1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 34, 41.

MSNM: from i24731 to i24796.

Description. It is a medium-sized caridean with thin and smooth exoskeleton, 1 to 5 cm in length.

Carapace. In lateral view in nearly all specimens, the carapace has a subrectangular shape and gets slightly narrow the anterior margin for the slight curvature of the ventral margin. The dorsal margin is straigth, while the posterior margin, strengthened by a thin marginal carina, is slightly sinuous, with a slight concavity in the lower third, partially covering somite I. The ventral margin has a curvilinear trend. The dorsal margin extends into an extremely long rostrum, with pointed distal extremity and strengthened by a thin longitudinal median carina that extends for its whole length. The rostrum bears 7 identical and forwards protruded suprarostral teeth and 3 subrostral teeth. The ocular incision is narrow and shallow and the antennal and pterygostomial angles are not very marked. No traces of grooves, carinae and spines can be observed on the surface of the carapace.

Abdomen. The abdomen shows the typical, almost right-angle curvature of carideans between somites III-IV. Somites I, III and IV have a subrectangular shape and uniform length. Somite II has a subround pleura partly overlapping that of somites I and III. Somite VI has a subrectangular

shape and it is slightly longer than the others. The posterior margin of somites III is slightly sinuous, while that of somites IV-V is posteriorly projecting. The telson has a triangular shape (Fig. 13), pointed distal extremity and bears one pair of long and thin spines at the distal extremity. One pair of thin and longitudinal carinae in the upper part and two pairs of small-sized and equidistant spines in the median and the lower part are present on the dorsal surface of the telson. The uropods are about 1/3 longer than the telson (Fig. 13). The protopodite, subrectangular in outline, supports the expodite. The exopodite, with rounded diaeresis, has crossed by a thin longitudinal carina running parallel to the outside lateral margin and ending with a small spine. The endopodite lacks any ornamentation.

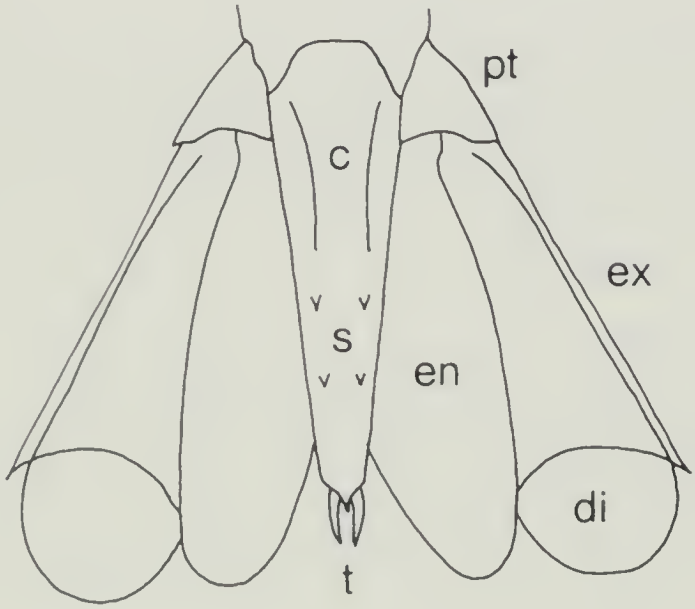

Fig. 13 - *Palaemon vesolensis* n. sp., tail fan, line drawing.

Cephalic appendages. They are well preserved not only in all complete specimens, but also in the incomplete specimens. The eye is supported by a short eye-stalk. The antennulae consist of three articula: the 1st thin and elongate, the 2nd not much elongate and the 3rd short and stocky to which three flagella are articulated (one short and two of the same lenght, about 1/3 the body length). The scaphocerite has a laminar shape and pointed distal extremity. A flagellum, twice the body lenght, is articulated to the subrectangular carpocerite of the antennae.

Thoracic appendages. Well preserved in almost all specimens. Thin, elongate and spineless articles form the 3rd maxilliped. The merus and carpus of the chelate pereiopods I-II are thin and elongate. The propodus and index of the chelae have the distal extremity slightly curved. Pereiopods III-V have a terminal dactylus and their articles are thin and strongly elongate.

Abdominal appendages. The pleopods consist of a subrectangular sympodite to which two elongate multiarticolate flagella are articulated.

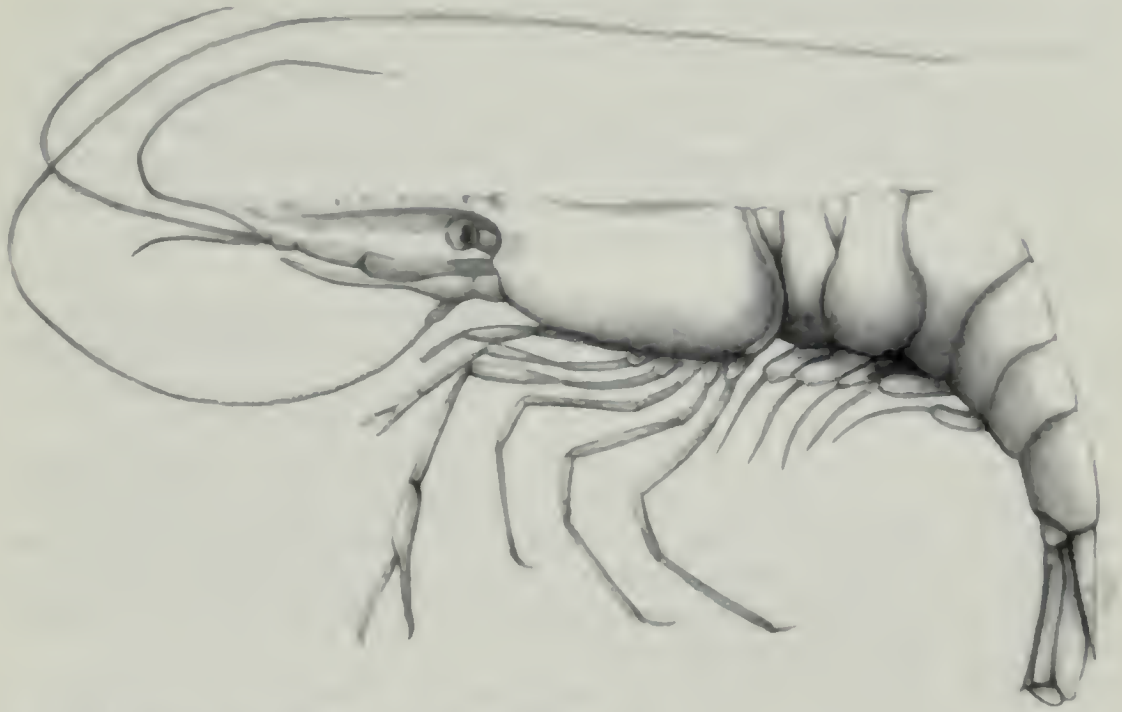

Fig. 14 - *Palaemon vesolensis* n. sp., reconstruction.

Observations

Carideans are very rare in the fossil record and their morphological features are not well known because of their poor state of preservation.

The most ancient genera known to date, *Acanthinopus* Pinna, 1974 and *Leiothorax* Pinna, 1974, were discovered in the Calcare di Zorzino (Norian, Upper Triassic) of Bergamo Prealps (Cene, Seriana Valley - Bergamo, N Italy) (Pinna, 1974). Another form, *Pinnacaris* Garassino & Teruzzi, 1993, was described in the Argilliti di Riva di Solto (Sevatian, Upper Norian-Lower Rhaetian, Upper Triassic - depending on the authors) of Ponte Giurino (Imagna Valley - Bergamo, N Italy) (Garassino & Teruzzi, 1993).

Glaessner (1969) ascribed to Jurassic only *Udorella* Oppel, 1862 (family Udorellidae Van Straelen, 1924). The same author ascribed also three *incertae sedis* Jurassic genera to carideans: *Blaculla* Münster, 1839, *Hefriga* Münster, 1839 and *Udora* Münster, 1839.

We presently know six genera of Cretaceous carideans.

Martins-Neto & Mezzalira (1991a) found a few specimens of carideans in the Crato Member of Santana Formation (Lower Cretaceous) of Brazil. The perfect state of preservation of these specimens allowed the authors to describe *Beurlenia* (Family Palaemonidae Rafinesque, 1815) with *B. araripensis*.

Roger (1946) described *Notostomus cretaceus* n. sp. on a sample of five specimens found in the Santonian (Upper Cretaceous) of Sahel Alma (Lebanon). This species was the subject of a recent review by Garassino (1994), who ascribed the species by Roger to *Odontochelion* nov. (family Oplophoridae Dana, 1852).

Rabadà (1993) described *Delclosia* nov. with *D. martinelli* n. sp. on a sample of 60 specimens of the Lower Barremian (Lower Cretaceous) of

Las Hoyas (Cuenca, Spain). This genus was the subject of a recent review by Garassino (1997).

Bravi & Garassino (1998a, b) recently described *Parvocaris* nov. with *P. samnitica* n. sp. (indeterminate family) on a sample of 14 specimens of the Lower Albian (Lower Cretaceous) of Pietraroia (Benevento, S Italy) and *Alburnia* nov. with *A. petinensis* n. sp. (family Palaemonidae Rafinesque, 1815) on a sample of 3 specimens of the Middle Albian (Lower Cretaceous) of Petina (Salerno, S Italy).

Garassino (1998) have described on a sample of three specimens from the Lower Cretaceous of the Valley of Cornappo River (Udine, NE Italy), *Tonellocaris* nov. with *T. brevirostrata* n. sp. (family Oplophoridae Dana, 1852).

Garassino & Ferrari (1992) reported the presence of only one specimen of caridean in the Senonian (Upper Cretaceous) of Trebiciano (Trieste, NE Italy) without ascribing it to a known family, genus and species. Garassino & Teruzzi (1995b) reported the probable presence of a new caridean form in the Upper Hauterivian-Lower Barremian (Lower Cretaceous) of Vernasso (Udine, NE Italy).

Only four genera of carideans are presently known in the Tertiary deposits.

Four species belong to *Bechleja* Hoŭsa, 1956, a typical form of freshwater deposits: *B. rostrata* Feldmann *et al.*, 1981 from the Eocene of the Green River Formation (Wyoming, USA); *B. inopinata* Hoŭsa, 1956 from the Oligocene of the Czechoslovakia; *B. bahiaensis* (Beurlen, 1950) and *B. robusta* Martins-Neto & Mezzalira, 1991 from the Oligocene of Brazil (Beurlen, 1950, Hoŭsa, 1956, Feldmann *et al.*, 1981, Martins-Neto & Mezzalira, 1991b).

In the Miocene deposists of N Caucasus (Russia) *Palaemon* Weber, 1795, *Pasiphaea* Savigny, 1816 and *Bannikovia* Garassino & Teruzzi, 1996 have been described with *P. mortuus* Smirnov, 1929, *P. mortua* Smirnov, 1929 and *B. maikopensis* Garassino & Teruzzi, 1996 respectively (Smirnov, 1929, Garassino & Teruzzi, 1996a).

On the grounds of what described, *Palaemon vesolensis* n. sp., *Alburnia petinensis* Bravi & Garassino, 1998, *Parvocaris samnitica* Bravi & Garassino, 1998 and *Tonellocaris brevirostrata* Garassino, 1998 represent the only four species of Italian Cretaceous carideans known to date of which *P. vesolensis* n. sp. and *A. petinensis* Bravi & Garassino, 1998 belonging to the same family Palaemonidae Rafinesque, 1815. Moreover, *P. vesolensis* n. sp. is one of the few fossil species of carideans known to date that can be ascribed with certainty to a known family by some definite characters. In fact the study of this species has pointed out some characters, such as the rostrum with many suprarostral teeth and some subrostral teeth, pereiopods I-II with merus and carpus strongly elongate and pereiopod II with a chela stronger and longer than that of pereiopod I. These characters allow to ascribe *P. vesolensis* n. sp. to the family Palaemonidae Rafinesque, 1815. Moreover, the perfect state of preservation of the examined specimens have allowed surely to ascribe them to the genus *Palaemon* Weber, 1795 thanks to some typical characters of this genus pointed out by Zariquiey Alvarez (1968): rostrum with many suprarostral teeth and some subrostral teeth, telson with

one pair of long and thin spines at the distal extremity and two pairs of small-sized spines in the median and in the lower part on the dorsal surface and three-flagellate antennulae.

The ascription of the examined specimens to *Palaemon* Weber, 1795 pulls back the stratigraphical range of this genus known to date, even though in dubitative form, in the Oligocene of Europe.

Conclusions

The geological and palaeontological observations carried out on the Plattenkalk with decapod crustaceans of Vesole Mount have allowed to point out:

1 - the Plattenkalk age is the Upper Cretaceous, probably Campanian-Maastrichtian;

2 - the Plattenkalk represents a coastal lagoonal biotope, with a scarce water-circulation and low oxygenation, high ecological stress, sedimentation mainly linked to tide contributions, subject to storms, populated by strongly oligotypic faunae and probably close to freshwater environments and land masses;

3 - decapod crustaceans are ascribed to *Palaemon* Weber, 1795 with *P. vesolensis* n. sp.. The presence of *Palaemon* Weber, 1795 in the Plattenkalk of Vesole Mount pulls back the stratigraphical range of this genus known to date, even though in dubitative form, in the Oligocene of Europe.

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Fig. 15 - *Palaemon vesolensis* n. sp., holotype, n. cat. A4491/8, photo and reconstruction (× 5).

Fig. 16 - *Palaemon vesolensis* n. sp., n. cat. A4491/1, photo and reconstruction (× 8).

Fig. 17 - *Palaemon vesolensis* n. sp., n. cat. A4491/19, photo and reconstruction (× 4).